

CLAIMS

What is claimed is:

1. A variable-impedance active ankle foot orthosis comprising an actuator for
5 modulating an impedance of an orthotic joint throughout a walking cycle for
treating an ankle foot gait pathology.
2. The device of Claim 1, wherein the orthosis includes a torsional spring stiffness
control.
- 10 3. The device of Claim 1, wherein the orthosis includes a spring-damper positional
control.
4. The device of Claim 1, wherein the actuator is coupled to a foot portion of the
15 orthosis.
5. The device of Claim 1, wherein the actuator includes a series elastic actuator.
6. The device of Claim 1, wherein the orthosis includes an ankle angle sensor.
- 20 7. The device of Claim 1, wherein the orthosis includes one or more ground
reaction force sensors.
8. The device of Claim 1, wherein the orthosis includes an actuator, an ankle angle
25 sensor, one or more ground reaction force sensors, and a controller for
controlling the orthosis.
9. The device of Claim 1, wherein the orthosis includes a foot switch.

10. The device of Claim 1, wherein the orthosis is used to treat drop foot gait.
11. The device of Claim 1, wherein the orthosis is used to treat a patient having anterior muscle weakness, posterior muscle weakness, or a combination thereof.
- 5 12. A device for treating an ankle foot gait pathology comprising:
an orthosis including a leg portion attachable to a leg of a person and a foot portion attachable to a foot of the person; and
an actuator attachable to the leg portion for acting on a spring disposed
10 between the actuator and the foot portion.
13. The device of Claim 12, wherein the actuator adjusts stiffness of the orthosis during controlled plantar flexion to minimize forefoot collisions with the ground.
- 15 14. The device of Claim 12, wherein the actuator minimizes the impedance during late stance.
15. The device of Claim 12, wherein the actuator applies a spring-damper positional
20 control during a swing phase.
16. The device of Claim 12, further comprising an ankle angle sensor.
17. The device of Claim 12, further comprising one or more ground reaction force
25 sensors.
18. The device of Claim 12, further comprising a controller for controlling the orthosis.

19. A method comprising modulating an impedance of an orthotic joint of an orthosis throughout a walking cycle.
20. The method of Claim 19, further including adjusting the stiffness of the orthotic joint during controlled plantar flexion to minimize forefoot collisions with the ground.
21. The method of Claim 20, wherein the stiffness of the orthotic joint is adjusted by applying a biomimetic torsional spring control.
22. The method of Claim 19, further comprising minimizing the impedance during late stance.
23. The method of Claim 19, further comprising applying a torsional spring-damper positional control during a swing phase.
24. A method of treating an ankle foot gait pathology using functional electrical stimulation, comprising applying electrical pulses to elicit muscle contractions to actively modulate ankle impedance to achieve a torsional spring control during controlled plantar flexion so as to minimize forefoot collisions with the ground, minimizing impedance during late stance, and achieving a spring-damper positional control during a swing phase.